

# NASA PROPAGATION PROGRAM STATUS AND PROPAGATION NEEDS OF SATCOM INDUSTRY

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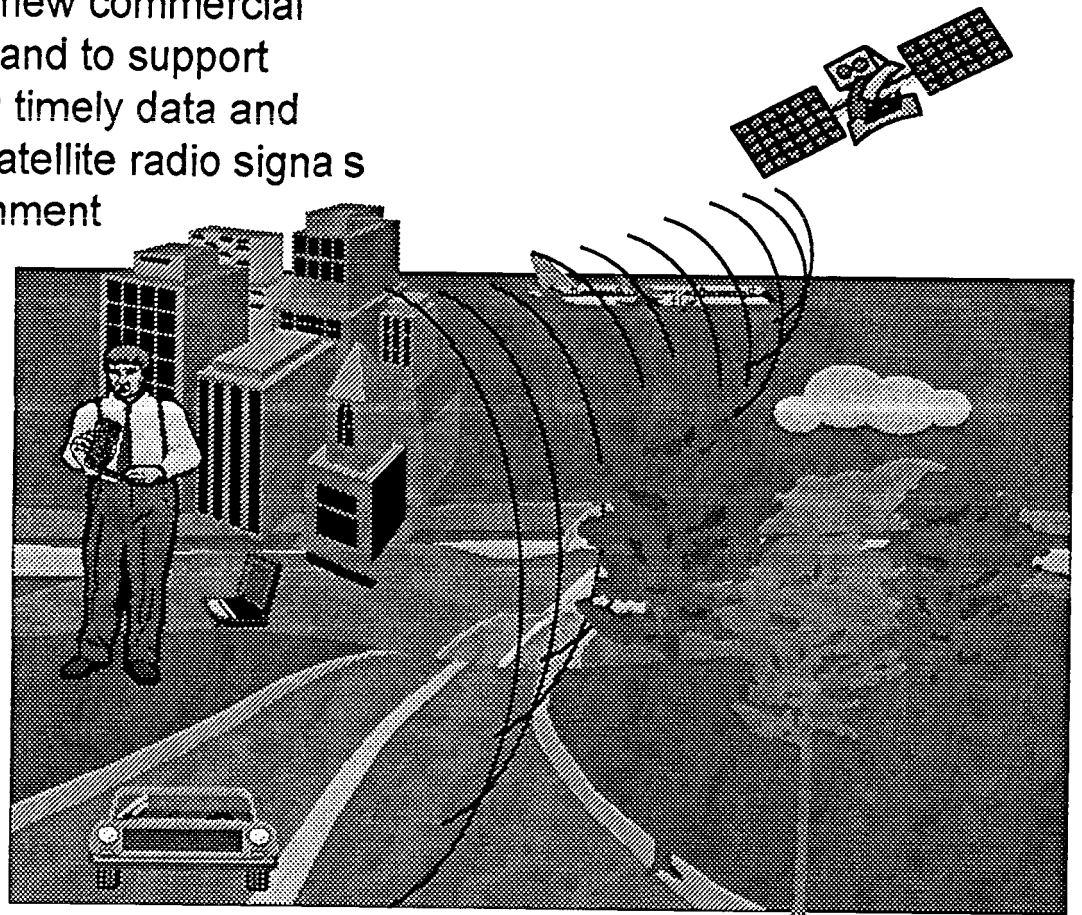
## NASA PROPAGATION PROGRAM

### PRESENTATION OUTLINE

- OBJECTIVE
- APPROACH
- THE NASA PROPAGATION PROGRAM: A PARTNERSHIP BETWEEN NASA, INDUSTRY, AND ACADEMIA
- SUMMARY OF INDUSTRY FEEDBACK AT NAPEX XX
- PLANS TO MEET THE SHORT-TERM PROPAGATION NEEDS OF THE SATCOM INDUSTRY
- UNDERSTANDING THE LONG-TERM PROPAGATION NEEDS OF THE SATCOM INDUSTRY
- FY 97 PLANS
- ACKNOWLEDGMENTS

## NASA PROPAGATION PROGRAM OBJECTIVES

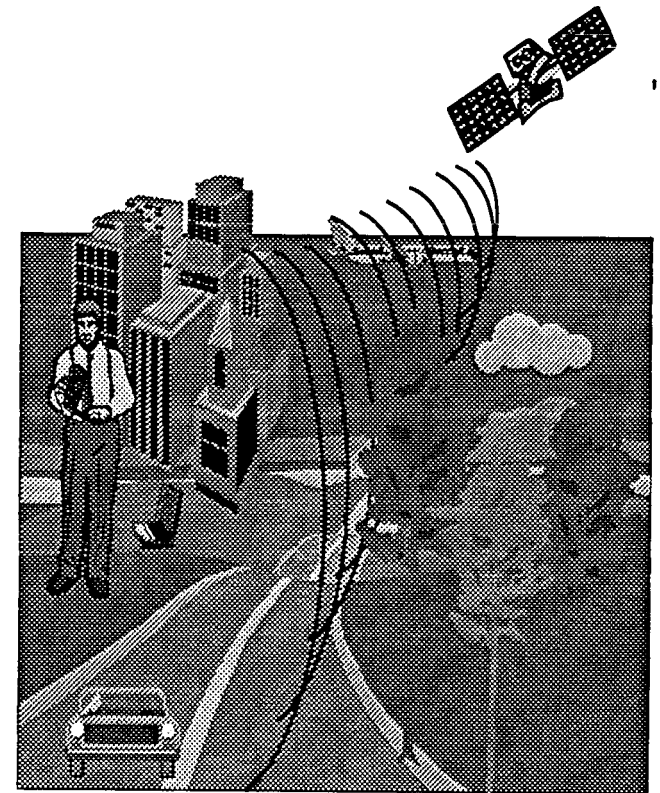
- To enable the development of new commercial satellite systems and services and to support NASA's programs by providing timely data and models about propagation of satellite radio signals through the intervening environment
  - New services
  - Higher frequencies
  - Higher data rates
  - Different environments
    - Mobile
    - Indoors
    - Fixed
  - Different orbits
    - Geostationary
    - Low Earth Orbit



## NASA PROPAGATION PROGRAM

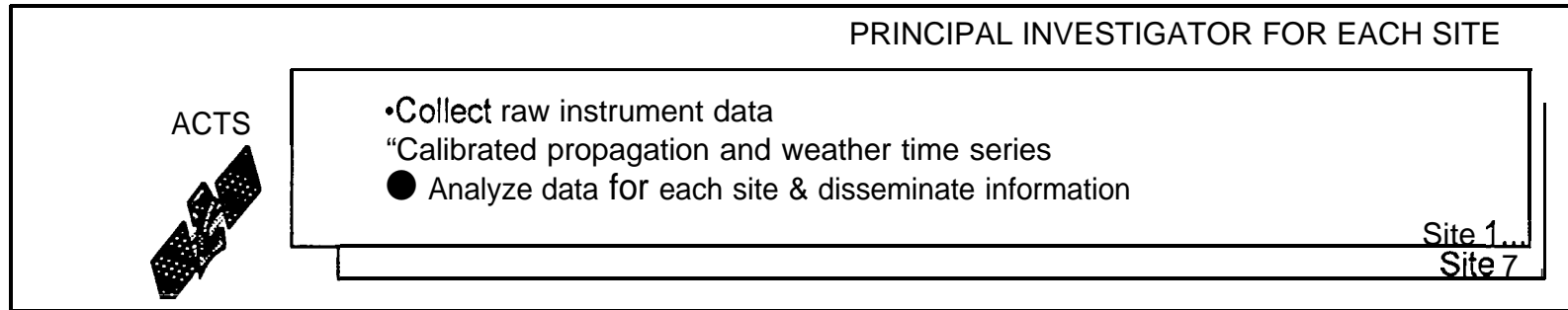
### APPROACH

- Leverage unique NASA assets (currently ACTS) and other resources to obtain propagation data
- Strong partnership between NASA, industry, and universities
- Dissemination of data and models through refereed journals, NASA reference handbooks, workshops, electronic media, and direct interface with industry

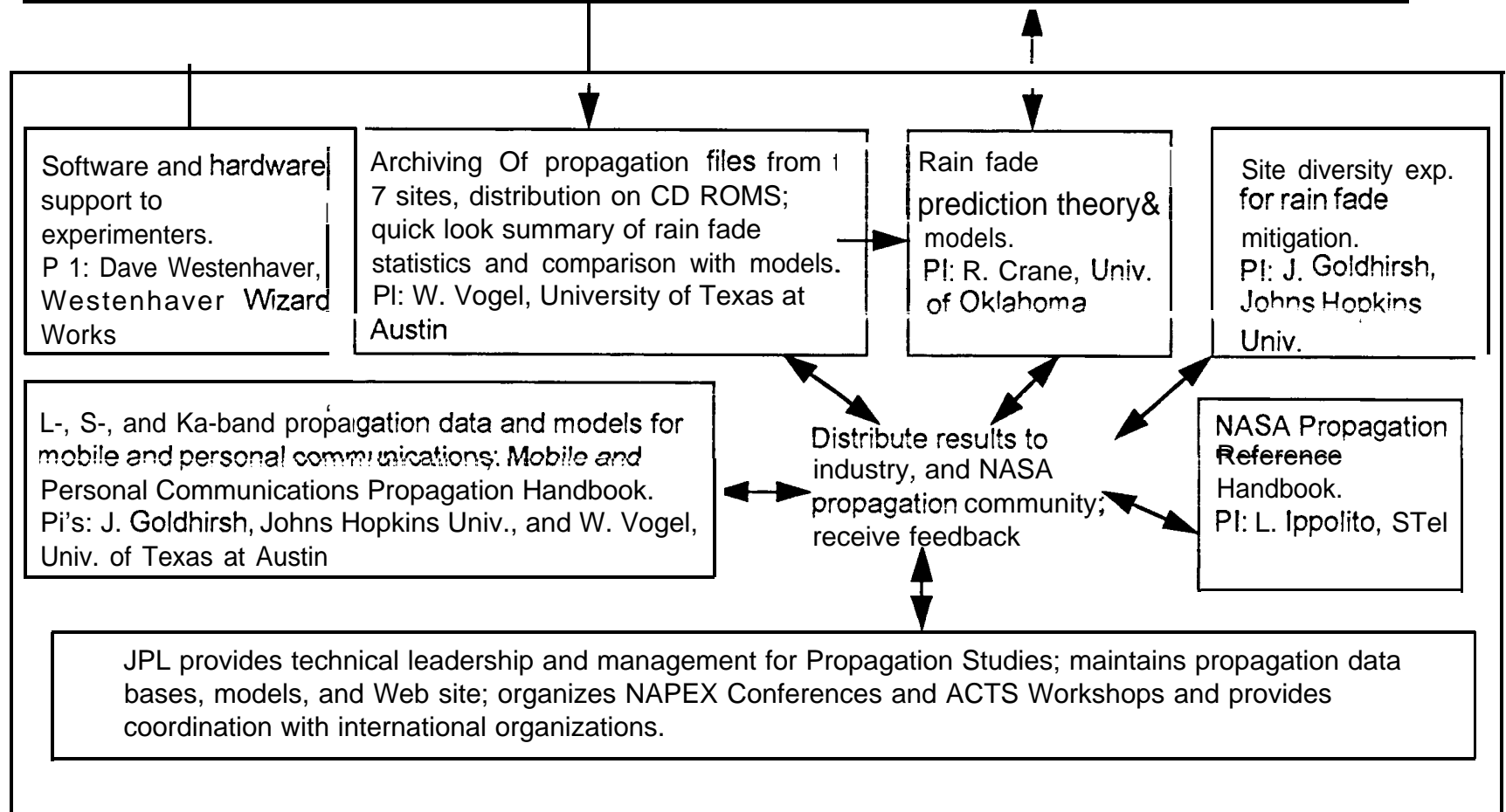


# NASA PROPAGATION PROGRAM A PARTNERSHIP BETWEEN NASA, INDUSTRY, AND ACADEMIA

ACTS EXPERIMENTS  
(R. Bauer, LeRC)



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NASA PROPAGATION PROGRAM (N. Golshan, JPL)



## NASA PROPAGATION PROGRAM SUMMARY OF INDUSTRY FEEDBACK AT NAPEX XX

- The NAPEX XX Conference provided an opportunity to present the status of the NASA Propagation Program to the U.S. Satcom Industry and get feedback.
  - U.S. Satcom Industry considers NASA Propagation Studies a national asset and critical to the industry.
  - U.S. Satcom Industry needs timely, easy-to-use propagation effects handbooks and internationally accepted, reliable prediction models for system design and coordination purposes across the globe.
    - Urgent need to revise the NASA propagation handbooks and publish electronically to allow timely, low-cost incremental updates.
    - Urgent need to have internationally accepted global model for prediction of rain & atmospheric propagation effects on satcom links.
    - Long-term plans needed to meet the future propagation needs of Satcom Industry.

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### Plans to Meet the Short-term Propagation Needs of the Satcom Industry

- Will accelerate efforts to validate and improve models for prediction of weather related impairments of Ka-Band satellite links to meet the urgent needs of the U.S. Satcom Industry.
  - 13 station-years of ACTS Ka-Band propagation data collected so far at 7 sites is an invaluable data base to validate and improve models for prediction of weather related impairments of Ka-Band satellite links.
    - This data represents the most extensive and reliable Ka-Band propagation data base existing today, thanks to extensive efforts to maintain the quality and continuity of ACTS Propagation Experiments.
    - Data is becoming available just in time for preliminary design of future Ka-Band satcom systems.
    - Summary comparison of ACTS Ka-Band data with prediction models indicates a need to revise the prediction models.
    - Extension of ACTS Propagation Experiments to November 1998 would provide 35 station-years of high quality data which would greatly facilitate international acceptance of ACTS propagation models by international and regulatory bodies.

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### Plans to Meet the Short-term Propagation Needs of the Satcom Industry (Cont'd)

- Will accelerate revision of NASA reference propagation handbooks to meet the urgent need of the Satcom Industry.
  - NASA Reference Publications 1182 (1982) and 1082 (1989) are being overhauled into an updated, one-volume "Propagation Effects Handbook for Satellite Systems Design"
  - NASA Reference Publication 1274 (1992) is being revised into an easy-to-use "Propagation Effects for Vehicular and Personal Communications Satellite Systems" handbook.
- The Propagation Web Site at JPL is being expanded along a fast track approach intended to streamline distribution of NASA propagation documents, data, and models electronically.
  - Low cost, quick implementation by leveraging an existing system already working at JPL.



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### Understanding the Long-term Propagation Needs of the Satcom Industry

- NAPEX XX provided a dialogue between the U.S. Satcom Industry and the NASA Propagation Program to understand the long-term propagation needs of the U.S. Satcom Industry for implementation of communications systems at Ka-band and higher frequencies, as well as for second-generation mobile satellite systems.
  - There is a strong need for easy-to-use global models to predict first& second order temporal and spatial propagation statistics about attenuation, coherence bandwidth & depolarization due to weather (precipitation & atmosphere) for line of sight satellite systems at Ka-Band and higher frequencies up to and including optical systems.
  - Second-generation mobile and personal satellite systems can greatly benefit from global models to predict first& second order temporal and spatial statistics about attenuation, coherence bandwidth and depolarization over the 1.0-30 GHz range due to blockage, reflection and scattering by objects near the mobile or personal terminal.

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### ACKNOWLEDGMENTS

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- Many individuals from NASA, academia, and industry have contributed to the success of the NASA Propagation Program and the NAPEX XX Conference; their contributions are reported separately as papers and overviews in this publication.